

REMARKS

In the Office Action dated January 21, 2003, claims 1-7, 9, 10, 12 and 14 are pending, claims 1, 2 and 14 are allowed and claims 3-7, 9, 10 and 12 are rejected. Applicants appreciate the acknowledgement of patentable subject matter in that only claims 3 and 7 are rejected over prior art. The above amendment is submitted to more particularly point out and distinctly claim the subject matter regarded as invention.

The amendment to blind ratio in claim 7 is supported particularly at page 26, line 16 to page 27, line 15. Also, it was intended in the prior amendment that claim 7 depend from claim 4. This is now corrected in the above amendment.

Claims 3-6, 9, 10 and 12 [sic] are rejected under 35 U.S.C. §112, second paragraph. It is believed that the above amendment overcomes these rejections. In view of the amendment, it is believed that claims 4-6, 9, 10 and 12, which were indicated to have allowable subject matter, now are allowable. Claim 7, which is dependent from claim 4, also should be allowable.

Regarding claim 3, the Examiner indicates that "the rejection as set forth at page 2, section (a), 1., of the previous Office Action" is maintained and it is assumed that applicants acquiesce in it. Applicants do not acquiesce. It was believed that this rejection was merely a misunderstanding. The "d" in claim 3 clearly relates to the term diameter (which precedes the d, first occurrence) and is meant to be a substitute for term diameter as subsequently used in the claim, e.g., "1.2d" meaning 1.2 times the diameter, as is standard nomenclature and understood by those skilled in the art.

The above submitted amendment of claim 3 regarding "d" is considered redundant, but submitted for further clarification.

Claims 3 and 7 are rejected under 35 U.S.C. §103(a) over The Hashimoto et al publication (Properties of Perforated Trays Devoid of Downcomers) and Mitsuho et al "Handbook of Distillation Engineering."

In the BACKGROUND OF THE INVENTION section of the present specification, the prior art perforated tray towers without downcomer disclosed by Hashimoto et al and Mitsuho et al are described **including their problems**. More specifically, that section states:

in some cases, distillation of, for example, (meth)acrylic acid, using the conventional perforated tray tower without downcomer [as disclosed in the documents -- author] causes formation of a polymer which should be removed manually or chemically after suspension of the operation.

It is further explained that the conventional perforated trays without downcomer designed to address these problems **fail** to concurrently and surely produce both the **first state** where the inside of the perforated tray tower without downcomer is made wet with a liquid containing an easily polymerizable compound **and** the **second state** where gas and/or liquid currents are prevented from channeling and stagnating.

Therefore, it would not have been obvious to one of ordinary skill in the art to combine the descriptions in *Properties of Perforated Trays Without Downcomer* and

Distillation Engineering Handbook and arrive at the present invention of a perforated tray without downcomer **wherein each of the plurality of holes has a diameter d and is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$.** There is no suggestion in these references or their combination for such structure **wherein each of the plurality of holes has a diameter d and is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$.** This structure of the perforated tray without downcomer, as presently claimed, is capable of *concurrently* and surely providing the **first state** where the inside of the perforated tray tower without downcomer is made wet with a liquid containing an easily polymerizable compound **and the second state** where gas and/or liquid currents are prevented from channeling and stagnating, **thereby preventing the formation of polymers with better efficiency**, and distilling an easily polymerizable compound in a stable manner over an extended period of time.

In other words, the perforated tray without downcomer of the present invention has unique elements (values and conditions), as set forth in the claims, that are not taught nor would they have been obvious to one of ordinary skill in the art based on the cited prior art. None of the cited art, alone or in combination, teach or suggest making the holes in the tray with **a center-to-center distance in a range of from $1.2d$ to $3d$.**

Claim 7 is directed to a perforated tray tower without downcomer, wherein the perforated tray tower comprises a plurality of perforated trays without downcomer disposed respectively at a plurality of stages, wherein the plurality of perforated trays

without downcomer disposed *respectively* at vertically adjacent spacing have a blind ratio of at least 0.2. In other words, each stage of the tray tower consists of a plurality of "perforated trays without downcomer" each of the trays in the stage being disposed at vertically adjacent spacing have a **blind ratio of not less than 0.2 and not more than 1**. This structure of the multiple tray stage provides a tower which is capable of *concurrently* and surely providing the **first state** where the inside of the perforated tray tower without downcomer is made wet with a liquid containing an easily polymerizable compound **and the second state** where gas and/or liquid currents are prevented from channeling and stagnating, **thereby preventing the formation of polymers with better efficiency**, and distilling an easily polymerizable compound in a stable manner over an extended period of time. None of the cited art teach or suggest anything about the blind ratio of vertically adjacent spacing of trays.

Nothing in the cited art would lead one of ordinary skill in the art to make a perforated tray without downcomer wherein each of the plurality of holes has a diameter d and is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$, as recited in Claim 3, or a perforated tray tower without downcomer, wherein the perforated tray tower comprises a plurality of perforated trays without downcomer disposed *respectively* at a plurality of stages, wherein the plurality of perforated trays without downcomer disposed *respectively* at vertically adjacent spacing have a blind ratio of not less than 0.2 and not more than 1, as recited in Claim 7.

Thus, it is respectfully submitted that the inventions of Claims 3 and 7 would not have been obvious to one of ordinary skill in the art in view of any combination of the cited art.

Included herewith is a marked-up version of the amendments to the subject application by the current amendment.

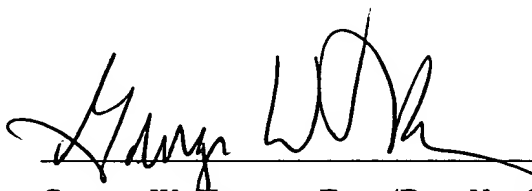
Applicants believe that additional fees are not required in connection with the consideration of the within matter. However, if for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge Deposit Account No. **04-1105**.

In view of the amendments and the discussion above, it is respectfully submitted that the present application is in condition for allowance. An early reconsideration and notice of allowance are earnestly solicited.

Respectfully submitted,

Date:

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VERSION WITH MARKINGS TO SHOW CHANGES MADE IN CLAIMS

Please note that additions to the claims are shown underlined and deletions are shown in brackets.

3 (amended). A perforated tray without downcomer provided with a plurality of holes, wherein

each of the plurality of holes has a diameter d and is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$, where d is the diameter of the hole.

4 (amended). A perforated tray tower without downcomer, comprising a plurality of perforated trays without downcomer disposed respectively at a plurality of stages, each of the plurality of perforated trays without downcomer being provided with a plurality of holes, wherein

each of the plurality of holes has a diameter d in a range of from 10mm to 25mm,

the perforated tray without downcomer has a thickness in a range of from 2mm to 8mm,

the perforated tray without downcomer has an opening ratio in a range of from 10% to 30%, and

each of the plurality of holes is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$,

wherein, when two or more of the plurality of perforated trays without downcomer are used at the same stage, the two most closely located holes that respectively belong to adjacent perforated trays are separated from one another by a center-to-center distance in a range of from 50mm to 150mm.

7 (amended). [A perforated tray tower without downcomer, comprising a plurality of perforated trays without downcomer disposed respectively at a plurality of stages] The perforated tray tower without downcomer according to claim 4, wherein

the plurality of perforated trays without downcomer disposed respectively at vertically adjacent spacing have a blind ratio of not less than 0.2 and not more than 1 [at least 0.2].

9 (amended). A method of distillation, comprising the step of distilling an easily polymerizable compound or a liquid containing an easily polymerizable compound, using a perforated tray tower without downcomer, comprising a plurality of perforated trays without downcomer disposed respectively at a plurality of stages, each of the plurality of perforated trays without downcomer being provided with a plurality of holes, wherein

each of the plurality of holes has a diameter d in a range of from 10mm to 25mm,

the perforated tray without downcomer has a thickness in a range of from 2mm to 8mm,

the perforated tray without downcomer has an opening ratio in a range of from 10% to 30%_o[0], and

each of the plurality of holes is separated from an adjacent hole by a center-to-center distance in a range of from $1.2d$ to $3d$,

wherein, when two or more of the plurality of perforated trays without downcomer are used at the same stage, the two most closely located holes that respectively belong to adjacent perforated trays are separated from one another by a center-to-center distance in a range of from 50mm to 150mm[,

wherein an easily polymerizable compound or a liquid containing an easily polymerizable compound is distilled].

10 (amended). The method of distillation as defined in claim 9, wherein the [distillation] distilling step is carried out under at least one of first and second conditions,

the first condition being such that an amount of wetting liquid with respect to a cross-sectional area of the tower is at least $0.3\text{m}^3/\text{m}^2 \cdot \text{h}$, and

the second condition being such that an amount of wetting liquid with respect to a sum of areas of the plurality of holes is at least $1\text{ m}^3/\text{m}^2 \cdot \text{h}$.

12 (amended). The method of distillation as defined in claim 9 [11],
wherein

the easily polymerizable compound is at least one compound selected from the group consisting of (meth)acrylic acid and esters thereof.